ExFoS - Expert Forensic Science

XXII. mezinárodní vědecká konference soudního inženýrství

Brno 2013

MOŽNOSTI VYHODNOCOVÁNÍ A POROVNÁVÁNÍ DAT ZÍSKANÝCH Z KONTROLNÍCH A SROVNÁVACÍCH PLOCH (KSP) VE VZTAHU KE ŠKODÁM PŮSOBENÝM ZVĚŘÍ NA LESNÍ POROSTY

POSSIBILITIES OF EVALUATION AND COMPARISON OF DATA OBTAINED FROM CONTROL AND COMPARISON PLOTS (CCP) IN RELATION TO DAMAGES CAUSED BY GAME TO FOREST.

Zbyněk Šafránek[118], Juho Matala[119]

ABSTRAKT:

Příspěvek se zabývá možnostmi vyhodnocování a interpretace dat, která jsou získávána a shromažďována z kontrolních a srovnávacích ploch (KSP). Povinnost zaznamenávání údajů v mladých lesních porostech dle kontrolních a srovnávacích ploch je dána zákonem č. 289/1995 Sb. resp. vyhláškou MZE č. 101/1996 Sb. Tyto plochy má povinoost zřizovat každý vlastník lesa o výměře nad 50 ha. Systém zkusných ploch je složen ze dvou čtvercových ploch o stranách 5 metrů, z nichž jedna je oplocena a druhá nikoliv. V současné době probíhá pouze každoroční sběr dat, ale tyto data už nejsou dále vyhodnocována. Tento příspěvek poukazuje na možnosti vyhodnocování takto získaných dat na příkladu finského národního parku Pisavaara.

ABSTRACT:

The article deals with the possibilities of evaluation and interpretation of data on game damages in forests which is obtained and collected from control and comparison plots (CCP). Obligation to record the data in young forest stands on the base of control and comparison plots is directed by Act No. 289/1995 Coll., respectively Ministry of Agriculture Decree No. 101/1996 Sb. Each forest owner who has more than 50 hectars of forest has obligation to establish control and comparison plots. System of these plots is composed of two square areas with sides of 5 meters, one of them is fenced, the second is not fenced. At present there is only annual gathering of data, but this data are not further evaluated. This article shows the possibilities of evaluation of this data by the example from the fencing experiment of Finnish Forest Research Institute in the strictly protected natural reserve Pisavaara, Northern Finland.

KLÍČOVÁ SLOVA:

Kontrolní a srovnávací plochy, oplocené plochy, okus, ohryz, škody zvěří

KEYWORDS:

Control and comparison plots, fenced plots, browsing, peeling, game damages

[118)] Šafránek, Zbyněk, Ing. – Ústav soudního inženýrství VUT Brno, Údolní 244/53, 602 00 Brno, + 420 725 749869, Zbynek.safranek@usi.vutbr.cz

[119)] Matala, Juho, D.Sc. – The Finnish Forest Research Institute, Yliopistokatu 6, 801 01 Joensuu, Finland, + 358 29 532 5275, Juho.matala@metla.fi

1 INTRODUCTION

Damages caused by game are a great problem for forestry in Czech republic. For evaluation of forest damages caused by wild game there has been created many methods. One of them is called „control and comparison plots" (further CCP). This method is based on two plots – one of them is fenced and second of them isn´t fenced. Obligation to record the data in young forest stands on the base of control and comparison plots is directed by Act No. 289/1995 Coll. forest act [1], respectively Ministry of Agriculture Decree No. 101/1996 Sb. [2]. Each forest owner who has more than 50 hectars of forest has obligation to establish control and comparison plots. Exact procedure of recording data is specified in guideline Ministry of Agriculture No. 14/96 [3]. There is also mentioned methodics of choice locality, demarcation of plots, requirement for fence and instruction for forest work near the plots. In this guideline is also registration sheet for data recording. Registration sheet is prepared for computer processing.

Now in Czech republic exists network of this control and comparison plots, there also exists methodology for data recording, but there isn´t central register of this data and central evaluation of this data. Data analysis is performed only by few forest owners or students, usually for small areas. It would be very interesting to evaluate and compare this data from the whole Czech republic.

2 MATERIALS AND METHODS

2.1 Law and acts

On the base of Ministry of Agriculture Decree No. 101/1996 Sb [2], each forest owner who has more than 50 hectars of forest has obligation to create one control and comparison plot. Further one plot for each other 500 hectars of forest. According guideline Ministry of Agriculture No. 14/96 [3] is necessary to established new plots on areas, where is starting of naturally or artifically forest regeneration. Area with control and comparison plots should not be near the feed rack, or near favorite places for game. System of control and comparison plots is composed of two square plots with sides 5 x 5 meters. First of them is fenced and second is not fenced. Borders of plots are far 2 – 10 meters. Control and comparison plots should be capture typical situation in area. Both plots have to be comparable by forest site type, the amount of light, character of vegetation, terrain and exposure. In first step, plots are provisionally marked in the field. The decision which plot will be fenced is made by random lottery ticket. Stabilisation of unfenced plot is created with using of wood stick with minimal diameter of 5 centimeters in the corners of plot. In the center of plot iron rod is placed. For fencing of control plot the mesh with minimaly height of 160 cm is used. In areas with red deer the mesh with height of 200 cm is used. For elimination of fence border effect is side of square 6 x 6 meters, but size for evaluation is 5 x 5 meters. Forest protection and other forest work must be the same in both plots.

First evaluation of results is performed immediately after creation of plots, usually from half of July to half of September. Another measurement is conducted annually in the same period. If the trees are over 1,3 – 1,5 m, forest owner must create new pair of plots.

2.2 Measured values

Form for recording the data from the CCP is prepared for computer evaluation. In the first part of the form there is given information about the forest owner, the owner´s contact and

identification of place where the area is located. There is also column for recording of the data relevant for farming - soil type, forest category and number of natural forest area.

Further, there are information about geological substrate, altitude and other habitat conditions (slope, exposure, location of area, fruiting trees and form of regeneration). It can be chosen from predefined possibilities and marked by cross. Evaluation of vegetation cover is made separately for the fenced and unfenced area. In this part there is filled in the plant coverage, height class, in the event that there is - browsing on trees, blackberries, raspberries, other shrubs, dwarf shrubs and herbs, grasses, ferns and mosses. All measured data are recorded in height classes. For trees, there is created a separate table where are recorded height classes and numbers of individuals of each tree species. Separatelly for fenced and unfenced area there are recorded damages of most important individuals (the most important individuals for forest regeneration). Furthermore, there is filled in the species, age, height class, origin, length of terminal shoots and eventual implementation of forest protection. Further, there is records on top shoot browsing or branch browsing damages if there is; and they are divided into old, new or repeated damages. Last, there is records on antler peeling damages and other damages (insects, mice, fungi, other).

2.3 The current status of evaluation CCP in Czech republic

The obligation to establish control and comparative areas for forest owners over 50 ha is determined by law. If the control and comparison plots are positioned correctly, they can provide very valuable information for foresters and gamekeepers. Based on the data obtained from CCP is possible to modify annually hunting plan - according to Decree No. 553/2004 Coll. (the conditions, the model and detailed instructions for the elaboration of game management plan) [4].

Installation, inspection and evaluation of CCP is time consuming and costly thing. For external data recording there was created quite sophisticated and computer-processable form. The central data gathering and evaluation of data from CCP from the whole country still does not exist. Collection and evaluation of data from CCP has been dealt for example Fiser, 2011 [5], or Svobodova, 2010 [6]. The evaluation of the data from CCP is currently on-going at the Institute of forest protection and game management at Mendel university in Brno. But usually the data has been evaluated for smaller forest areas, mostly owned by the state. Evaluation of data obtained from private, municipal and other owners is problematic and at very different levels. There is no uniform method for data processing obtained from the CCP.

2.4 Control and comparison plots in strictly protection area Pisavaara (Finland)

The fencing experiment was established by Finnish Forest Research Institute in strictly protected natural reserve Pisavaara in 1997 as part of larger series of fencing experiments - from results of other areas see e.g. Heikkilä & Tuominen, 2009 [7]. The Pisavaara is situated in Northern Finland (Latitude: 66.266667 / Longitude: 25.1; altitude 100-260 m above sea-level) in the middle boreal vegetation zone, the area of the reserve is 4 891 ha and there is no human interference of any kind allowed (entrance to reserve is under permission given only for research purposes). The forests in the reserve are dominated by old-growth Norway spruce and Scots pine stands. In some part of the area there are rocky hills and typical for the area are also spruce mires. Bedrock of the area is quartzite and soils are podzolic typical for boreal forests.

The main species in the area that can cause browsing damages are moose (*Alces alces L.*) and semi-domesticated reindeer (*Rangifer tarandus tarandus L.*). Also arctic hare (*Lepus timidus*

L.) can have some effect on trees; and voles (*Microtus oeconomus Pallas* and *Microtus agrestis L.*) can cause severe damages in their peak-years. Moose (*Alces alces L.*) in the area typically browse shoots of pines (*Pinus sp.*) and broadleaved trees specially in wintertime, debark trees specially in spring-winter and defoliate trees in summer. Reindeer (*Rangifer tarandus tarandus L.*) mainly defoliate broadleaved trees in summer, hare usually cut shoots of small broadleaved trees and debark specially aspen (*Populus sp.*). Voles (*Microtus sp.*) usually debark small seedlings but *Microtus agrestis L.* can eat top-shoot twigs and debark shoots even from pine (*Pinus sp.*) and spruce (*Picea sp.*) trees of 1.5-2 m height. Speciality of the area is that moose (*Alces alces L.*) are claimed to come to reserve area specially during hunting season because they cannot be hunted there. This is interesting since at that time of year (autumn) the area cannot provide as much food as neighbouring areas of young economic forests.

At the time of establishment the fencing experiment area was in a stage of early natural regeneration after small-scale windfall disturbance in old-growth spruce (*Picea* sp.) forest of *Myrtillus*-type. There was built an fenced squared shaped exclosure with 50 m side lenght. There was established 9 circle sample plots with 2.52 meter radius in regular order both inside and outside the fence. First data was measured at the establishment in 1997, next in 2003, 2006 and 2011.

Tree-level measurements were made for tree species in ten categories. 1. Scots pine (*Pinus sylvestris L.*), 2. Norway spruce (*Picea abies L.*), 3. Silver birch (*Betula pendula Roth.*), 4. Pubescent birch (*Betula pubescens Ehrh.*), 5. Aspen (*Populus sp.)*, 6. Alder (*Alnus sp.*), 7. Juniper (*Juniperus sp.*), 8. Rowan *(Sorbus sp.)*, 9. willow (*Salix sp.*), 10. Other tree species. For each individual was measured height. Further, if it was represented there were measured growth, diameter at height 1.3 m, old and new top shoot browsing (number and diameter), old and new branch browsing (number and diameter divided into 10 clases by milimeters). In case of representation bushy trees, defoliated trees, dead trees, peeling damaged trees and in case of represent new fecal pellets it was signed.

3 RESULTS AND DISCUSSION

Methodology for evaluation of data obtained from the CCP is currently specific to the each forest owners. In this time no exist generally binding or centralized process for data analyse. In many cases the CCP are in a dysfunctional state [6], or do not exist at all, even if their establishment was mandated by law.

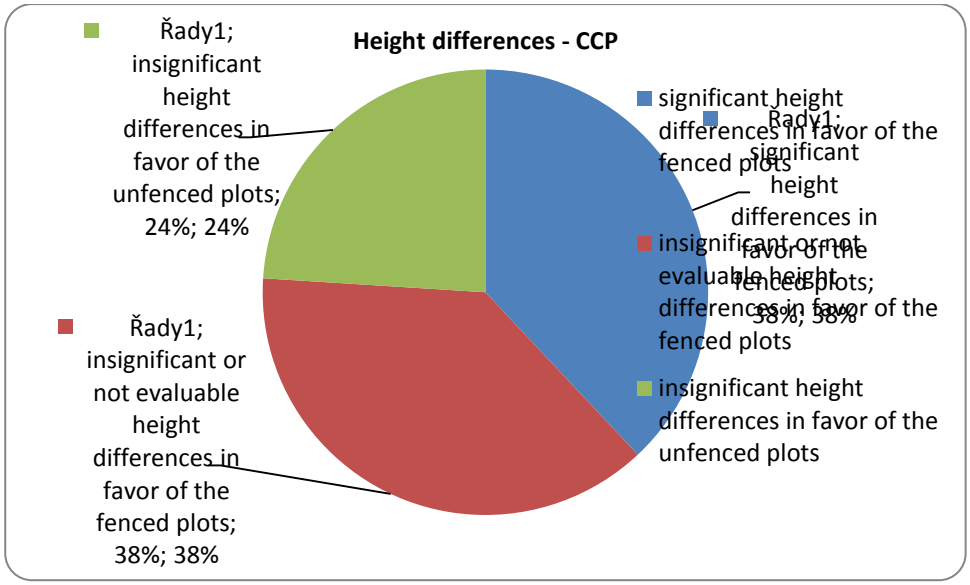
Fiser, 2011 [5] in his thesis evaluated the results obtained from the CCP situated in forest area Bučovice (state owned). The aim of the study was to evaluate the applicability of CCP for evaluation of damages caused by game. Author compared the results obtained from the CCP with a young forest, which was established at the same time near the area with CCP. Part of young stands was fenced and part wasn´t fenced. For evaluate of browsing author used the browsing coefficient (Q).

$$Q = \frac{Total\ height\ increment\ in\ the\ fenced\ area - Total\ height\ increment\ in\ the\ unfenced\ area}{Total\ height\ increment\ in\ the\ fenced\ area}$$

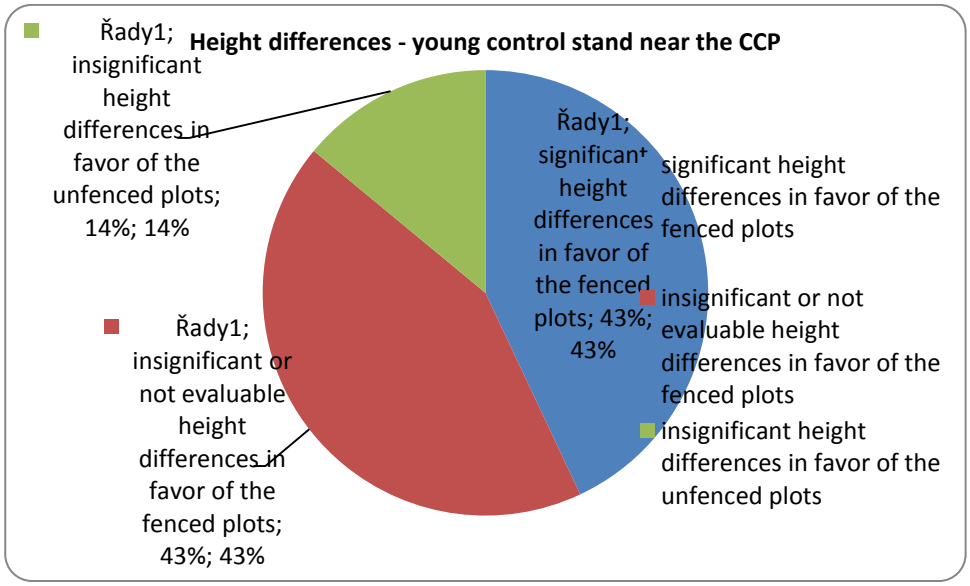
Total height increment was evaluated for the period when the trees on non-fenced area was available for game . If Q coefficient exceed 0.35, it means critical value – Perko, 1983 [8].

Fiser, 2011 [5] evaluated 8 CCP. Seven CCP had natural forest regeneration and in one case was represented artificially forest regeneration. In the fenced and also nonfenced areas beech (*Fagus sylvatica L.*) was the most represented - 78%, respectively 94%. Other tree species

were not used for evaluate of the applicability of CCP. Height differences for beech (*Fagus sylvatica L.*) in the control and comparative plots are shown in Fig. 1.



Obr. 1 – Graf významnosti výškových rozdílů – KSP (Fišer, 2011)
Fig. 1 – Chart of height diferencies – CCP (Fiser, 2011)



Obr. 2 – Graf významnosti výškových rozdílů – mladý kontrolní porost (Fišer, 2011)
Fig. 2 – Chart of height diferencies – young control stand (Fiser, 2011)

Differences of heights in young control stands near the CCP are shown in Fig. 2. Fiser, 2011 [5] reported that were not significant differences in heights of individuals beech (*Fagus sylvatica*) in the CCP and young control stands near the CCP. CCP methodology therefore has, in this conditions good predictive value. However in most cases, according to the Q factor forests in study area are not excessively damaged by wild game.

Evaluation of data from CCP was also performed by Svobodova, 2010 [6]. Data were collected in the Military Forests area, division Hořovice. There was evaluated 50 CCP on five

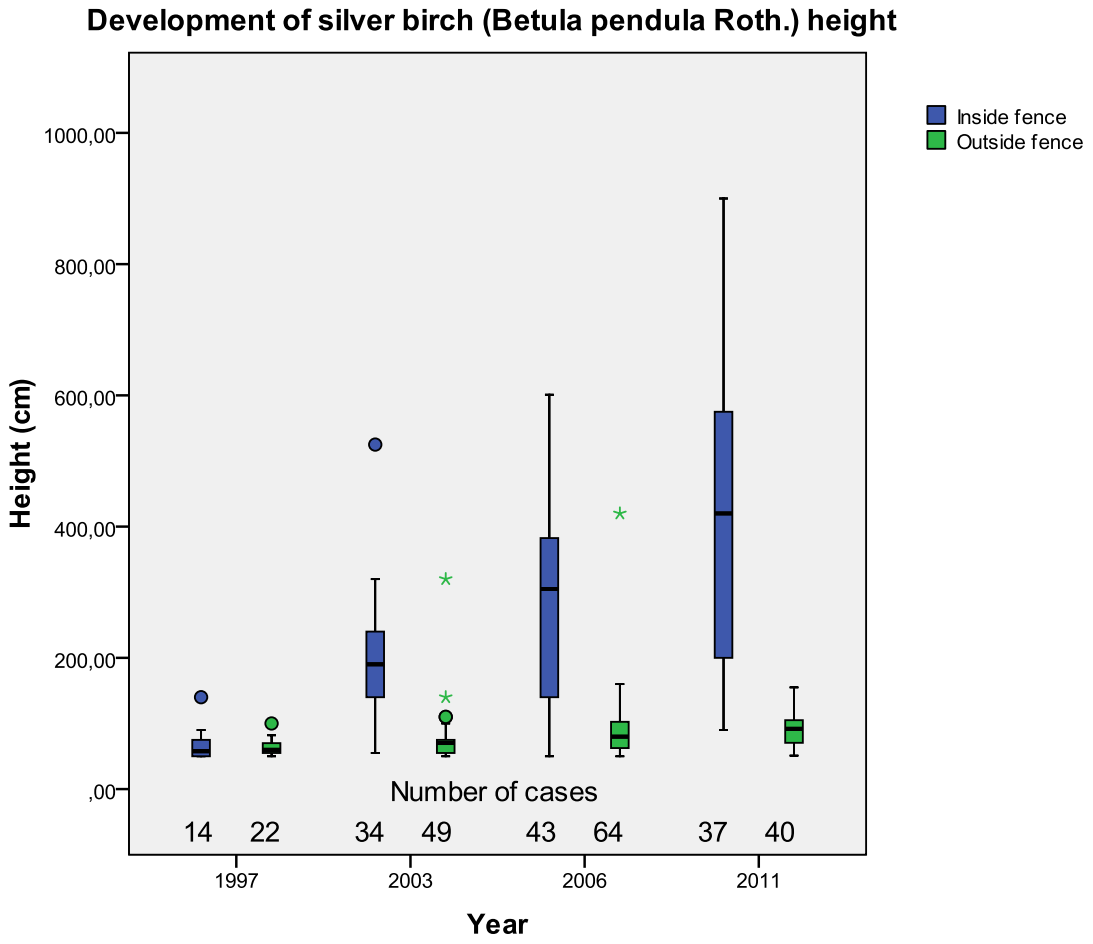
forest administration areas. Author focused mainly on the evaluation of the number of trees by height classes in fenced and unfenced areas and on the evaluation of browsing of the most important trees individuals. Author divided tree species into coniferous and deciduous. In both groups of trees further divided height clases less than 50 cm and more than 50 cm. Height classes of conifers were represented similar in fenced areas and unfenced areas. For deciduous trees was significant difference in the height class above 50 cm in favor of fenced areas. Dividing into height classes for the whole area Hořovice shown Tab. 1.

Tab. 1 – Rozdělení dřevin do výškových tříd (Svobodová 2010)
Tab. 1 – Dividing of tree species into height classes (Svobodova 2010)

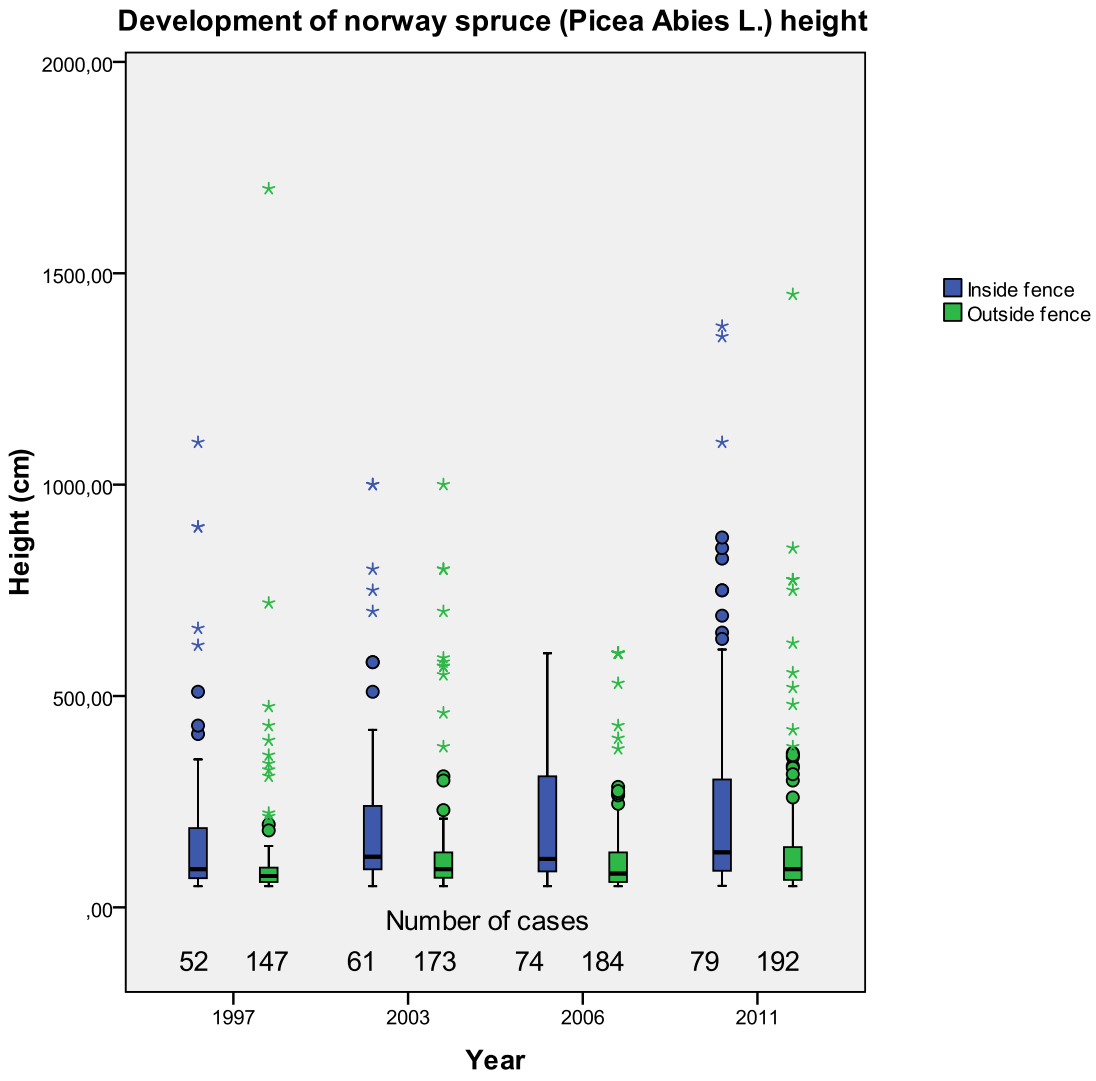
	Average number of individuals per plot (pcs)	Coniferous less than 50 cm (%)	Coniferous above 50 cm (%)	Deciduous less than 50 cm (%)	Deciduous above 50 cm (%)
Fenced plots	36,6	37,7	53,0	1,6	7,7
Unfenced plots	33,7	42,1	51,9	4,2	1,8

For evaluation of browsing damages was chosen 503 most important individuals from fenced plots and 543 most important individuals from unfenced plots. Due to the poor condition of one CCP was found browsing in four cases of spruce (*Picea sp.*) individuals in fenced area. Top shoot browsing in the unfenced areas was found at total of 208 individuals. In the unfenced areas by the top shoot browsing was affected 37.5% of coniferous trees and 64.5% of deciduous trees. However, large differences were detected within individual forest administrations. The causes can be in an uncorrect choice of locality for CCP, or condition of CCP.

In 1997 established system of nine control and comparison plots of fencing experiment in Finnish strictly protected nature reserve, Pisavaara, was analysed based on tree height development and browsing pressure on trees. Firstly height analyse in statistic program was made (SPSS 17). There were created 10 charts for each tree species. This charts was divided according years and according fence and non-fence part. In this charts was used box-plot type of chart with dividing into four quartils and there are showed also median values. In addition there are showed extreme values - stars and points. Because in 2006 weren´t measured heights less than 50 cm, there was used data filter for separation of trees 50 cm and more. Further for each tree species was made frequency table, which shows number of cases per each year and per inside/outside area. Fig. 3 shows dividing of silver birch (*Betula pendula Roth*.) heights and Fig. 4 shows dividing of norway spruce (*Picea abies L.*) heights.



Obr. 3 - Rozdělení výšek břízy bělokoré (Betula pendula Roth.) v kvartilech
Fig. 3 - Dividing of silver birch (Betula pendula Roth.) heights into quartiles



Obr. 4 - Rozdělení výšek smrku obecného (Picea abies L.) v kvartilech
Fig. 4 - Dividing of norway spruce (Picea abies L.) heights into quartiles

Other part of analyse was aimed to tree damages in non-fenced plots and comparation with fenced plots. There were registred two main types of damages – new top shoot browsing and new branch browsing. For data analyse spss statistic 17 program was used. There were created frequency tables with damaged and non-damaged trees. For displaying the results the stacked column chart in Excel was used. In non-fenced areas there are four categories with tree damage:

1) Only new branch browsing (there are not trees with new top shoot browsing and trees without damage)

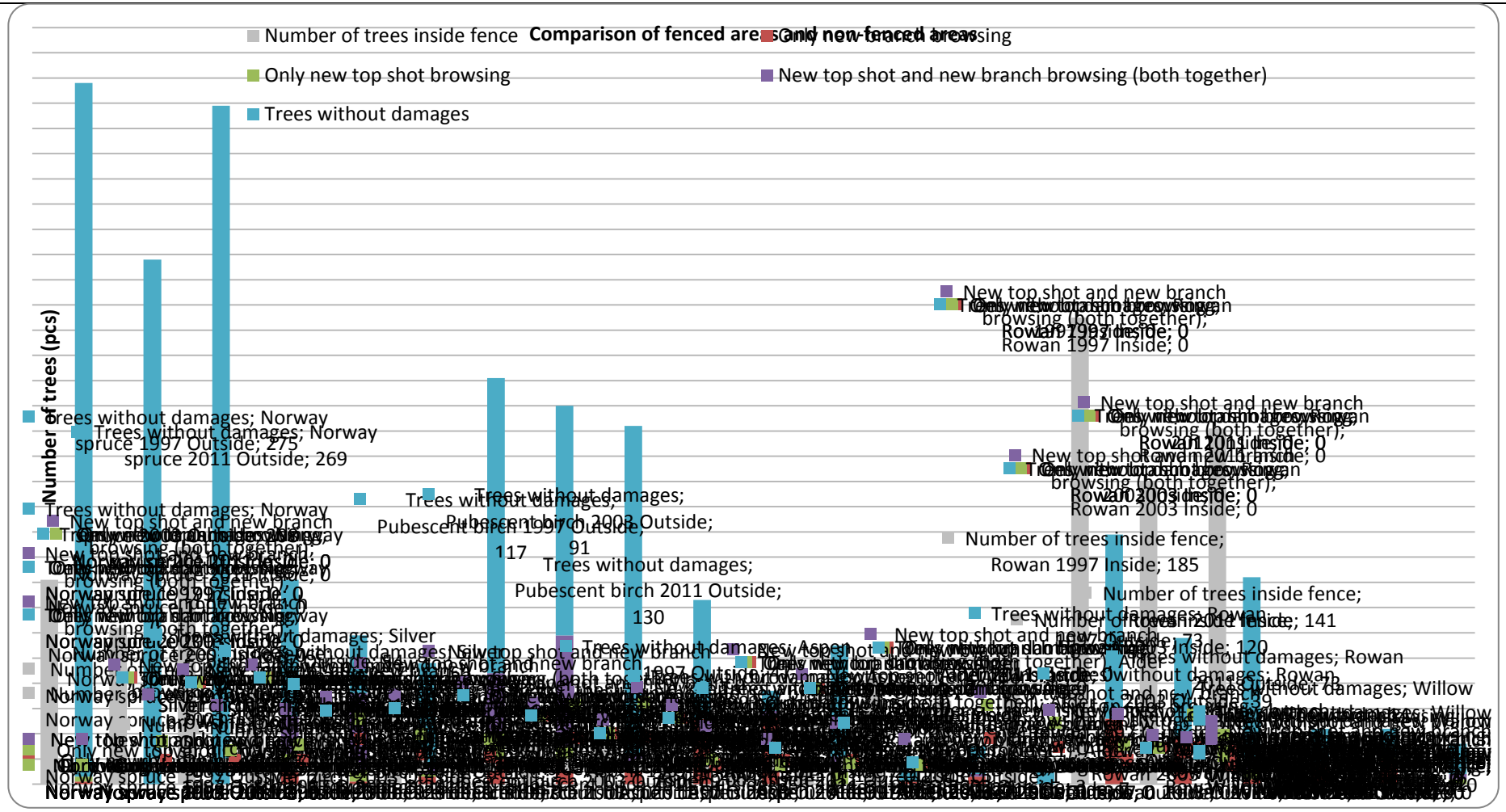
2) Only new top shoot browsing (there are not trees with new branch browsing and trees without damage)

3) New top shoot and new branch browsing (there are trees where is occurring both types of damages)

4) Trees without damages

Sum of these four categories is total number of trees in non-fenced areas. For comparing was added bar with number of trees in fenced areas. In this analyse are also trees less than 50 cm (total number of trees is higher than in development of height analyse). Fig. 5 shows diferencies between fenced and unfenced areas for seven tree-species (other tree species have not enough cases).

Results show clear browsing preference by moose on aspen (*Populus sp.*), rowan (*Sorbus sp*.), willows (*Salix sp*.) and birches (*Betula sp*.) in the Pisavaara area (Fig. 5). As there is no spruce (*Picea sp.*) damages, it is not suprise that height development seems similar inside and outside the fence (Fig. 4). On contrary to this, browsing on preferred species e.g. rowan (*Sorbus sp*.), aspen (*Populus sp*.) and silver birch (*Betula pendula Roth*.) causes severe effect on their height development (Fig. 3).



Obr. 5 – Počty dřevin na oplocených a neoplocených plochách
Fig. 5 – Number of tree species in fenced and unfenced areas

4 CONCLUSION

Information obtained from the CCP can provide valuable information for forest owners and gamekeeper. It is important to build a CCP in the correct location and periodically check and upkeep it. Only in this case it can provide correct information. For example we can detect how the game affect height increment, total height, species composition, number of trees per unit of area. Each tree species has a different attraction for wild game. Intensive browsing of all trees in area indicates the abnormal state of wild game. The intensity of browsing on individual tree species can be used as an indicator of endurable amount of wild game in the area – Homolka, 1995 [9]. Tolerable browsing of only most attractive tree species shows that amount of wild game for the area is in limit - Padajga, 1984 [10]. Examples of exact criteria according to which it would be possible to assess the maximum amount of wild game worked for example - Plhal and Kamler, 2010 [11], or Zatloukal, 1995 [12]. On the basis of the data analysis obtained from the CCP – Fiser, 2011 and Svobodova, 2010 [5] [6] we can say that wild game to affect especially height increment of trees. Statistically significant variations are also in the number of individuals in fenced and unfenced areas, especially for deciduous trees. According to the analysis by CCP in the Finnish nature reserve Pisavaara is evident that animals can significantly reduce the height increment of their most preferred species.

Assessing the impact of wild game to young forest stands according to CCP is a useful method and should be serve as one of arguments for process of create of hunting plan for next year. For applicability of CCP method for practical work is important to create uniform methodology for data gathering and evaluating. It would be desirable to define the boundary (for example degree of browsing) to which is impact of wild game endurable. The question remains whether 1 CCP density per 500 ha area is sufficient for these needs. After some adjustments CCP method is certainly one of useful method for evaluating of wild game impact on nature, but never can´t be used as the sole indicator.

5 LITERATURE SOURCE

[1] MINISTERSTVO ZEMĚDĚLSTVÍ ČESKÉ REPUBLIKY: *Zákon č. 289/1995 Sb. ze dne 3. listopadu 1995 o lesích a o změně a doplnění některých zákonů (lesní zákon).* Sbírka zákonů České republiky, částka 76 rozesláno dne 15. prosince 1995.

[2] MINISTERSTVO ZEMĚDĚLSTVÍ ČESKÉ REPUBLIKY: *Vyhláška č. 101/1996 Sb. ze dne 28. března 1996 kterou se stanoví podrobnosti o opatřeních k ochraně lesa a vzor služebního odznaku a vzor průkazu lesní stráže.* Sbírka zákonů České republiky, částka 33 rozesláno dne 29. dubna 1996.

[3] MINISTERSTVO ZEMĚDĚLSTVÍ ČESKÉ REPUBLIKY: *Metodický pokyn č. 14/96 ze dne 25. listopadu 1996 – kontrolní a srovnávací plochy*. Č.j. 165/96-5040 e.o.

[4] MINISTERSTVO ZEMĚDĚLSTVÍ ČESKÉ REPUBLIKY: *Vyhláška č. 553/2004 Sb. ze dne 26. Října 2004 o podmínkách, vzoru a bližších pokynech vypracování plánu mysliveckého hospodaření v honitbě.* Sbírka zákonů České republiky, částka 188 rozesláno dne 8. listopadu 2004.

[5] FIŠER, M.: *Zhodnocení použitelnosti kontrolních a zkusných ploch pro hodnocení vlivu zvěře na les*. Bakalářská práce, Brno, 2011, 79 s.

[6] SVOBODOVÁ, M.: *Hodnocení funkce systému zkusných a kontrolních ploch správy Vojenské lesy a statky divize Hořovice*. Bakalářská práce, České Budějovice, 2010, 37 s.

[7] HEIKKILÄ, R. & TUOMINEN, M.: *The influence of moose on tree species composition in Liesjärvi National Park in Southern Finland*. Alces, 2009, 45: 49-58.

[8] PERKO, F.: *Bestimmung des hochstzulassigen Verbissgrades am Jungwuchs. Schweizerische Zeitschrift für Forstwesen*. 1983, 134(3): 179-189.

[9] HOMOLKA, M.: *Některé aspekty potravní ekologie vybraných druhů zvěře ve vztahu k problematice obnovy lesních ekosystémů*. In Sborník referátů z konference „Škody zvěří a jejich řešení‘‘. Brno, 1995 MZLU, 124 s.

[10] PADAJGA, V.I.: *Ekologičeskije osnovy upravlenija čis-lennosti olenich v Litovskoj SSR*. 1984, Diss., Tartu, 33 pp.

[11] KAMLER, J. & PLHAL, R.: *Hospodaření s únosnými stavy zvěře: Kritéria, možnosti monitoringu a dopady na myslivost*. Myslivost, 2010, 4:22-23.

[12] ZATLOUKAL, V.: *Lesní hospodářství a myslivost*. In Sborník referátů z konference „Škody zvěří a jejich řešení‘‘. 1995, Brno, MZLU, 17-23.